CLAIMS:

1. An optical signalling system comprising first and second signalling devices,

the first signalling device comprising means for receiving an optical signal transmitted from said second signalling device and carrying uplink data transmitted from said second signalling device; an optical to electric converter for converting a portion of the received optical signal into a corresponding electric signal; means for processing the corresponding electric signal to retrieve said uplink data; means for modulating a portion of the received optical signal with downlink modulation data for the second signalling device and for reflecting the portion of the received optical signal back to the second signalling device; and

the second signalling device comprising means for generating an optical signal; means for modulating the generated optical signal with said uplink data for the first signalling device; means for outputting the optical signal towards said first signalling device; means for receiving the reflected optical signal from said fist signalling device carrying said downlink data; and means for retrieving the downlink data from said reflected signal;

characterised in that said modulating and reflecting means also acts as said optical to electric converter.

2. A system according to claim 1, wherein said

modulating, reflecting and optical to electric converting means comprises a Quantum Confined Stark Effect device.

3. A system according to claim 1 , wherein said first and second signalling devices are operable to transmit said uplink data and said downlink data in a time multiplexed manner.

4. A system according to claim 3, wherein said modulation, reflection and optical to electric converting means comprises an electrode which is connected, via a switch, to said processing means and to a bias voltage generator which is operable to generate a bias voltage in dependence upon the downlink data to be transmitted to said second signalling device, and wherein said time multiplex communication is controlled by controlling the position of said switch.

5. A system according to claim 1 , wherein said first and second signalling devices are operable to modulate different characteristics of said optical signal.

6. A system according to claim 5, wherein said first and second signalling devices are operable to transmit said uplink data and said downlink data simultaneously.

7. A system according to claim 6, wherein said modulation, reflection and optical to electric converting

means comprises an electrode which is connected to an inverting input of a transinpedence amplifier and wherein the non-inverting input of said transinpedence amplifier is connected to a bias voltage generator which is operable to generate a bias voltage in dependence upon the downlink data to be transmitted to said second signalling device and wherein the output signal from said transinpedence amplifier varies in dependence upon the uplink data transmitted from said second signalling device.

8. An optical signalling system comprising first and second signalling devices,

the first signalling device comprising means for receiving an optical signal transmitted from said second signalling device and carrying uplink data transmitted from said second signalling device; an optical to electric converter for converting a portion of the received optical signal into a corresponding electric signal; means for processing the corresponding electric signal to retrieve said uplink data; means for modulating a portion of the received optical signal with downlink modulation data for the second signalling device and for reflecting the portion of the received optical signal back to the second signalling device; and

the second signalling device comprising means for generating an optical signal; means for modulating the generated optical signal with said uplink data for the first signalling device; means for outputting the optical

signal towards said first signalling device; means for receiving the reflected optical signal from said first signalling device carrying said downlink data; and means for retrieving the downlink data from said reflected signal;

characterised in that said second signalling device comprises:

first and second generating means for generating first and second optical signals;

means for combining the first and second optical signals output by said first and second generating means;

wherein said modulation means of said second signalling device is operable to modulate said first optical signal; and

wherein said first signalling device is arranged so that the first optical signal carrying said uplink data is directed onto said optical to electric converter means and so that said second optical signal is directed onto said modulating and reflecting means.

9. A system according to claim 8, wherein said first and second generating means are operable to generate optical signals having a different polarisation state and wherein said first signalling device comprises a polarising beamsplitter for splitting the first and second optical signals.

10. A system according to claim 8, wherein said second signalling device further comprises means for changing

the polarisation state of at least one of the generated optical signals and wherein said first signalling device comprises means for splitting the received first and second optical signals.

11. A system according to claim 8, wherein said first and second generating means are operable to generate optical signals having different wavelengths and wherein said first signalling device comprises a wavelength sensitive beamsplitter for separating the optical signals from the first and second generating means.

12. A system according to claim 8, wherein said second signalling device further comprises means for converting the polarisation of the combined optical signal to circular polarisation and for converting the circular polarised reflected light back to linear polarised light and further comprises a polarising beamsplitter for separating the reflected signal from the transmitted signal.

13. An optical signalling system comprising first and second signalling devices,

the first signalling device comprising means for receiving an optical signal transmitted from said second

signalling device; means for modulating the received optical signal with modulation data for the second signalling device and for reflecting the received optical signal back to the second signalling device; and

the second signalling device comprising means for generating an optical signal; means for outputting the optical signal towards said first signalling device; means for receiving the reflected optical signal from said first signalling device carrying said modulation data; and means for retrieving the modulation data from said reflected signal;

characterised in that said second signalling device comprises:

first and second generating means for generating first and second optical signals having different wavelengths;

means for combining the first and second optical signals output by said first and second generating means;

in that said first signalling device comprises:

a wavelength sensitive beamsplitter for splitting said first and second optical signals; and

wherein said modulating and reflecting means comprises a first modulation and reflecting means for modulating and reflecting the first optical signal with first modulation data and second modulation and reflecting means for modulating the second optical signal with second modulation data; and

wherein said second signalling device further comprises a wavelength sensitive beamsplitter for

separating the reflected first and second optical signals and wherein said retrieving means comprises first and second retrieving means for retrieving the first and second modulation data respectively.

14. A system according to claim 13 wherein said second signalling device further comprises means for converting the polarisation of the combined optical signal to circular polarisation and for converting the circular polarised reflected back to linear polarised light and further comprises a polarising beamsplitter for separating the reflected signal from the transmitted signal.

15. A system according to claim 13. , wherein said first and second modulating and reflecting means comprises a Quantum Confined Stark Effect device.

16. A system according to claim 1, wherein said first signalling device further comprises focussing means for focussing the received optical signal onto said reflecting means.

17. A system according to claim 16 wherein said focussing means comprises a telecentric lens and wherein said reflecting means is located substantially at the focal plane of said lens.

18. A system according to claim 17 wherein said

telecentric lens is a wide angled telecentric lens.

19 A system according to claim 16 wherein said modulating means is transmissive and is located between said focussing means and said reflecting means.

20. A system according to claim 1, wherein said modulating means and said reflecting means are co-located.

21. A system according to claim 1 wherein said modulating means and said reflecting means are separate elements.

22. A system according to claim 1, wherein said first signalling device comprises a plurality of modulating and reflecting means for modulating and reflecting optical signals received from a plurality of second signalling devices.

23. A system according to claim 22 wherein said plurality of modulating and reflecting means are arranged in an array.

24. A system according to claim 23 wherein said plurality of modulating and reflecting means are arranged in a regular array.

25. A system according to claim 24 wherein said plurality of modulating and reflecting means are arranged in a two dimensional array.

26. A system according to claim 1, wherein said reflecting means comprises a retro-reflector.

27. A system according to claim 1, wherein said modulating means is operable to modulate at least one of the amplitude, phase, frequency or polarisation of the received signal.

28. A system according to claim 1, wherein said modulating means comprises a quantum confined stark effect device.

29. A system according to claim 1, wherein said second signalling device is operable to transmit a message to said first signalling device and wherein said first signalling device comprises means for retrieving the message from the received signal.

30. A system according to claim 1, wherein said generating means comprises a laser, a laser diode or a light emitting diode.

31. A system according to claim 1, wherein said second signalling device further comprises

an optical beam expander for increasing the diameter of the optical signal output towards said first signalling device.

32. An optical signalling method characterised by the use of a system according to claim 1.

33. A signalling system comprising first and second signalling devices,

the first signalling device comprising a receiver for receiving a signal output from the second signalling device and carrying uplink data transmitted from the second signalling device; a converter for converting a first portion of the received signal into a corresponding electric signal; a processor for processing the corresponding electric signal to retrieve said uplink data; and a modulator and reflector for modulating a second portion of the received signal with downlink data for the second signalling device and for reflecting the second portion of the received signal back to the second signalling device; and

the second signalling device comprising a generator for generating a signal; a modulator for modulating the

intensity of the generated signal between a first non-zero intensity level and a second non-zero intensity level in dependence upon said uplink data for the first signalling device; an outputter for outputting the intensity modulated signal towards said first signalling device; a first receiver for receiving the reflected signal from said first signalling device carrying said downlink data; and a data retriever for retrieving the downlink data from said reflected signal;

characterised in that said second signalling device further comprises a second receiver for receiving a signal indicative of current signal attenuation characteristics of a signalling channel between said first and second signalling devices through which said output signal and said reflected signal pass; and a controller for dynamically varying the difference in intensity between said first and second intensity levels in dependence upon the received signal indicative of the current signal attenuation characteristics of said signalling channel.

34. A system according to claim 33, wherein said modulator and reflector are formed as a single device comprising a Quantum Confined Stark Effect device.

35. A system according to claim 33 wherein said first and second signalling devices are operable to transmit said uplink data and said downlink data simultaneously.

36. A system according to claim 33, wherein said modulator of said first signalling device is operable to intensity modulate the second portion of the received signal between third and fourth non-zero intensity levels, with the difference in intensity between the third and fourth intensity levels being greater than the difference in intensity level between the first and second intensity levels.

37. A system according to claim 33, wherein said generator comprises a laser, a laser diode or a light emitting diode.

38. A system according to claim 33, wherein said second signalling device further comprises a determining unit for determining said signal indicative of the current signal attenuation characteristics of the signalling channel between the first and second signalling devices.

39. A system according to claim 38, wherein said determining unit is operable to determine said measure using a measure of the signal level of the reflected signal received back from said first signalling device.

40. A system according to claim 33, wherein said controller is operable to vary the lowest intensity level of said first and second non-zero intensity levels in dependence upon the strength of the reflected signal

received back from said first signalling device.

41. A system according to claim 40, wherein said controller is operable to vary said difference in dependence upon the lowest intensity level of said first and second intensity levels.

42. A system according to claim 33, wherein said controller of said second signalling device comprises:

a first current source for generating a drive current;

a second current source for generating a bias current;

a first solid state switch having first and second main electrodes and a control electrode, the first main electrode being connected, in use, to said first current source and the second main electrode being connected, in use, to a reference potential;

a second solid state switch having first and second main electrodes and a control electrode, the first main electrode being connected, in use, to said first current source and the second main electrode being connected, in use, to said signal generator and to said second current source;

a first connector for receiving a first data signal corresponding to said uplink data and a second data signal corresponding to the inverse of said uplink data signal;

a second connector for applying said first data

signal to the control electrode of said first solid state switch to open and close said first solid state switch in dependence upon the first data signal;

a third connector for applying said second data signal to the control electrode of said second solid state switch to open and close said second solid state switch in dependence upon the second data signal;

whereby the current applied in use to said signal generator corresponds to (i) the bias current provided by said second current source summed with the current from the first current source when said second solid state switch is closed; and (ii) the bias current provided by said second current source when said second solid state switch is open.

43. A system according to claim 42, wherein said controller further comprises a capacitor connected between the control electrode of said first solid state switch and the second main electrode of said second solid state switch.

44. A drive circuit according to claim 43, wherein the capacitance of said capacitor is set in dependence upon an inherent capacitance between the control electrode and the second main electrode of said second solid state switch.

45. A drive circuit according to claim 44, wherein the capacitance of said capacitor is set to be

approximately equal to the inherent capacitance between said control electrode and said second main electrode of said second solid state switch.

46. A system according to claim 33, wherein said first signalling device further comprises a focussing element for focussing the second portion of the received signal onto said reflector.

47. A system according to claim 46, wherein said modulator is transmissive and is located between said focussing element and said reflector.

48. A system according to claim 33, wherein said first signalling device further comprises a focussing element for focussing the first portion of the received signal onto the convertor.

49. A system according to claim 46, wherein said focussing element comprises a telecentric lens and wherein said reflector and/or said convertor is located substantially at the focal plane of said telecentric lens.

50. A system according to claim 33, wherein said modulator and said reflector are co-located.

51. A system according to claim 33, wherein said first signalling device comprises a plurality of

modulators and reflectors for modulating and reflecting optical signals received from a plurality of second signalling devices.

52. A system according to claim 51 wherein said plurality of modulators and reflectors are arranged in an array.

53. A system according to claim 33, wherein said reflector comprises a retro-reflector.

54. A system according to claim 33, wherein the data rate of said uplink data and said downlink data is substantially the same.

55. A signalling system comprising first and second signalling devices,

the first signalling device comprising a receiver for receiving a signal output from the second signalling device and carrying uplink data transmitted from the second signalling device as a small signal modulation of the output signal; a converter for converting a first portion of the received signal into a corresponding electric signal; a processor for processing the corresponding electric signal to retrieve said uplink data; a modulator and reflector for modulating a second portion of the received signal with downlink data for the second signalling device and for reflecting the second portion of the received signal back to the second

signalling device; and

the second signalling device comprising a generator for generating a signal; a modulator for applying a small signal modulation to said generated signal with said uplink data for the first signalling device; an outputter for outputting the modulated signal towards said first signalling device; a receiver for receiving the reflected signal from said first signalling device carrying said downlink data; and a data retriever for retrieving the downlink data from said reflected signal;

characterised in that said second signalling device further comprises: a second receiver for receiving a signal indicative of current signal attenuation characteristics of a communications channel between said first and second signalling devices through which said output signal and said reflected signal pass; and a controller for dynamically varying a modulation depth of the small signal modulation applied to said generated signal in dependence upon the received signal indicative of the current signal attenuation characteristics of said communications channel.

56. A drive circuit for applying a drive current to a signal generator, the drive circuit comprising:

a current source for generating a drive current;

a first solid state switch having first and second main electrodes and a control electrode, the first main electrode being connected, in use, to said current source and the second main electrode being connected, in use,

to a reference potential;

a second solid state switch having first and second main electrodes and a control electrode, the first main electrode being connected, in use, to said current source and the second main electrode being connected, in use, to said signal generator;

a first connector for receiving a first data signal and a second data signal, the second data signal being the inverse of the first data signal;

a second connector for applying said first data signal to the control electrode of said first solid state switch to open and close said first solid state switch in dependence upon the first data signal; and

a third connector for applying said second data signal to the control electrode of said second solid state switch to open and close said second solid state switch in dependence upon said second data signal;

whereby current from said current source passes, in use, either through said first solid state switch to said reference potential or through said second solid state switch to said signal generator in dependence upon said first and second data signals;

wherein the drive circuit further comprises a capacitor connected between the control electrode of said first solid state switch and the second main electrode of said second solid state switch.

57. A drive circuit according to claim 56, wherein the capacitance of said capacitor is set in

dependence upon an inherent capacitance between the control electrode and the second main electrode of said second solid state switch.

58. A drive circuit according to claim 57, wherein the capacitance of said capacitor is set to be approximately equal to the inherent capacitance between said control electrode and said second main electrode of said second solid state switch.

59. A drive circuit according to claim 56, wherein said current source is a first current source, further comprising a second current source connected to said second main electrode of said second solid state switch and operable to apply, in use, a bias current to said signal generator, whereby the current applied in use to said signal generator corresponds to i) the bias current provided by said second current source summed with current from the first current source when said second solid state switch is closed; and ii) the bias current provided by said second current source when said second solid state switch is open.

60. A signalling system comprising first and second signalling devices,

the first signalling device comprising a receiver for receiving a signal output from the second signalling device; a modulator for modulating a portion of the received signal with modulation data for the second

signalling device and for reflecting the portion of the received signal back to said second signalling device; and

the second signalling device comprising a generator for generating a signal; an outputter for outputting the generated signal towards said first signalling device; a receiver for receiving the reflected signal from said first signalling device carrying said modulation data; and a data retriever for retrieving the modulation data from said reflected signal;

characterised in that said second signalling device further comprises a processor for processing the reflected signal received at said second signalling device to derive a measure of the dynamic range of variation of the reflected signal; a comparator for comparing the derived measure with a predetermined threshold value to provide a comparison result; and a controller for dynamically varying the signal level of said generated signal in dependence upon the comparison result.

61. A signalling system according to claim 60, wherein said processor of said second signalling device is operable to process said signal to determine a measure of the signal strength of the reflected signal received at the second signalling device.

62. A system according to claim 60, wherein the reflected signal received at the second signalling device

comprises a DC component and an AC component and wherein said processor comprises a filter for filtering out either the DC component or the AC component and is operable to process the filtered signal to derive said measure.

63. A system according to claim 62, wherein said filter is operable to filter out said DC component and wherein said processor is operable to derive said measure by calculating an average power level of the AC component.

64. An apparatus according to claim 60, further comprising an adjuster for adjusting the predetermined threshold value.

65. An apparatus according to claim 60, wherein said controller of said second signalling device is operable to control the transmitted signal level to be at a minimum necessary for said data retriever to be able to retrieve the modulation data from said reflected signal.

66. A signalling device comprising:

a generator for generating a signal; a modulator for varying the intensity of the generated signal between a first non-zero intensity level and a second non-zero intensity level in dependence upon uplink data to be transmitted to a remote signalling device;

an outputter for outputting the intensity modulated signal towards said remote signalling device;

a first receiver for receiving a reflected signal back from said remote signalling device carrying downlink data transmitted from the remote signalling device; and

a data retriever for retrieving the downlink data from said reflected signal;

characterised in that the signalling device further comprises a second receiver for receiving a signal indicative of current signal attenuation characteristics of a signalling channel between said signalling device and said remote signalling device through which said output signal and said reflected signal pass; and a controller for dynamically varying the difference in intensity between said first and second intensity levels in dependence upon the received signal indicative of the current signal attenuation characteristics of said signalling channel.

67. A signalling device comprising:

a generator for generating a signal;

an outputter for outputting the generated signal towards a remote signalling device;

a receiver for receiving a reflected signal from said first signalling device carrying modulation data; and

a data retriever for retrieving the modulation data from said reflected signal;

characterised in that said signalling device further

comprises a processor for processing the reflected signal to derive a measure of the dynamic range of variation of the reflected signal;

a comparator for comparing the derived measure with a predetermined threshold value to provide a comparison result; and

a controller for dynamically varying the signal level of said generated signal in dependence upon the comparison result.

68. An optical signalling method characterised by the use of a signalling system according to claim 33,

69. An optical signalling method characterised by the use of a signalling device according to claim 66.

70. An optical signalling method characterised by the use of a signalling device according to claim 67.